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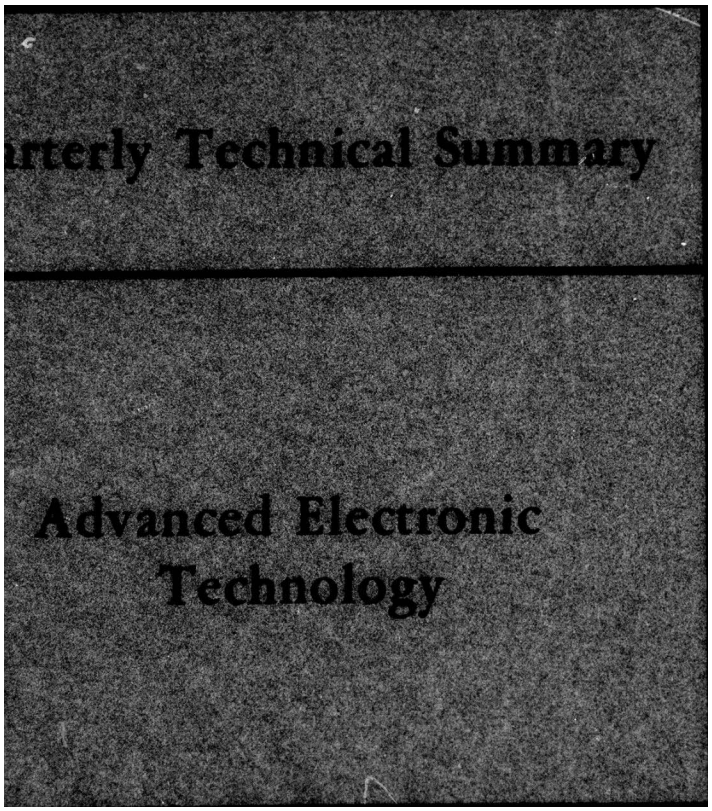
rterly Technical Summary
Advanced Electronic
Technology

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FOR THE COMMANDER

Raymond L. Loiselle, Lt. Col., USAF
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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LINCOLN LABORATORY

ADVANCED ELECTRONIC TECHNOLOGY

QUARTERLY TECHNICAL SUMMARY REPORT
TO THE
AIR FORCE SYSTEMS COMMAND

1 FEBRUARY – 30 APRIL 1978

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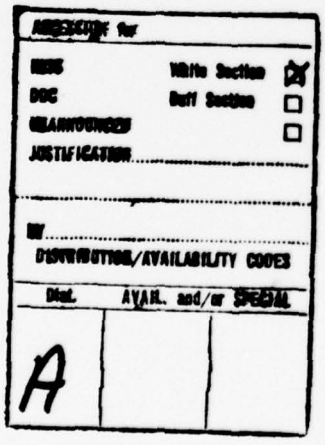

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INTRODUCTION

This Quarterly Technical Summary covers the period 1 February through 30 April 1978. It consolidates the reports of Division 2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program.

CONTENTS

DATA SYSTEMS
DIVISION 2

INTRODUCTION

This section of the report reviews progress during the period 1 February through 30 April 1978 on Data Systems. Separate reports describing other work of Division 2 are issued for the following programs:

Seismic Discrimination	ARPA/NMRO
Distributed Sensor Networks	ARPA/IPTO
Education Technology	Bureau of Mines, ARPA/CTO, AFCS
Network Speech Processing	OSD-DCA
Voice Conferencing Technology	OSD-DCA
Digital Voice Processing	AF/ESD
JTIDS Speech Processing	AF/ESD
Packet Speech	ARPA/IPTO
Wideband Integrated Voice/Data Technology	ARPA/IPTO
Radar Signal Processing Technology	ARMY/BMDATC
Nuclear Safety Designs	NRC

M. A. Herlin
Head, Division 2

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Associate Head

DIGITAL INTEGRATED CIRCUITS
GROUP 23

I. INTRODUCTION

A revised version of the 1-GHz 8-bit serial/parallel converter is being built using the poly-ox isolation process and a high-speed 16 × 16 multiplier is under design. Final circuit and layout details were completed for the converter and a multiplier test chip. The advantages of amorphous-silicon (a-Si) isolation for MNOS memory devices were demonstrated and effort is now focused on this fabrication process for 64 K chips.

II. HIGH-SPEED DIGITAL CIRCUITS

A. Serial/Parallel Converter

For better high-frequency performance, the serial output of the 1-GHz serial/parallel converter was changed from an ECL emitter-follower circuit to an open-collector circuit which has output voltages of 0.0 and −0.6 V.* The serial input was changed to be compatible with the output. The lower speed parallel output circuits remain ECL compatible. Masks for the converter and associated evaluation chip are being generated.

B. MUDPAC (16- × 16-Bit Multiplier Chip)

The masks for the test chip are nearing completion. In addition to testing the basic circuits, the test chip will help evaluate a power-distribution scheme in which the buses are designed for uniform power voltage drop to all circuits rather than for minimum drop from bonding pad to circuit. Also, maximum use is made of 2nd-level metallization. This approach promises to reduce the chip area devoted to power buses at the expense of layout complexity.

C. Poly-Ox Isolation

A major yield limiter in the poly-ox process is transistor emitter-collector leakage which is directly affected by defect density in the epitaxially deposited single crystal silicon. The defect density has been found to be critically dependent on every processing step performed prior to epitaxy. Experiments with initial oxidation indicate that a visually superior silicon surface is obtained with wet oxidations at 920° or 1000°C with the density of visual defects rapidly increasing as the oxidation temperature is elevated. A buried-collector arsenic dose rate of 30 μA gives a smooth silicon surface after drive in and oxide strip whereas the previously employed 100-μA dose rate frequently resulted in an "orange-peel" surface and poor epitaxy. This is probably due to wafer heating and partial self annealing at the higher dose rate. The literature suggests that such an implanted layer consists of small crystalline regions of random orientation which is harder to anneal to an ordered crystalline state than a completely amorphous layer.

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* D. M. DiPietro, "A 5-GHz f_T Monolithic IC Process for High-Speed Digital Circuits," Proceeding of the 1975 IEEE International Solid State Circuits Conference (February 1975), pp. 118-119.

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III. MNOS MEMORY

A. Chip Fabrication Results

The first group of six runs of 64K partially decoded memory chips has been completed and a second set of six runs initiated. Due to a variety of process related problems the first group of runs resulted in no functional memory chips. However, it was determined that the a-Si isolation process gives such superior isolation characteristics as compared to the air-isolation process that all future memory arrays will use a-Si isolation. Three major problem areas currently associated with the 64K-chip process are: (1) low dielectric breakdown in the MOS decoding transistors, (2) partial field-nitride removal when stripping the Rotox used to mask the Ne implant, and (3) oxidation-induced defects in the Si surface resulting in surface pitting, particularly during the H_2 etch used just prior to epitaxial growth. Potential solutions for all three of these problems have been identified and are being pursued.

A run of 30 × 30 a-Si isolated MNOS arrays on SOS (silicon on sapphire) has been completed. Excellent isolation as well as good storage and readout were obtained in these arrays. MOS transistors will be fabricated on SOS to evaluate the feasibility of producing SOS 64K memory chips.

B. Mask Design

The second generation of the 64K memory will have major changes in the decoding circuits. Some experiments have been done to determine details of the changes, but others are needed which require new test structures. A chip containing such structures has been designed and masks have been ordered.

Masks are being designed for first attempts to fabricate devices with 1- and 1/2-μm geometry. Existing 30 × 30 array patterns having 2.5-μm digit lines will be overlaid with word lines having 1-μm lines and spaces and 1/2-μm lines and spaces.

C. Amorphous Isolation

Neon-implanted a-Si samples have been measured and characterized. At low electric fields the resistivity of the amorphous material is constant at about 5×10^5 Ω-cm. This value is only weakly dependent on initial doping density. At high fields ($> 10^4$ V/cm) the conductivity begins to increase as $\ln(I) = \beta \sqrt{E}$, which would indicate the onset of Poole-Frankel conduction. Metal seems to form good ohmic contact with the amorphous region; no barrier effects have been seen. A junction forms in the boundary between amorphous and crystalline silicon. Work is currently aimed at characterizing this boundary region.

D. Processing

Implantation of As into gate oxide during formation of N+ contacts leads to severe stress for a dose 2×10^{15} atoms/cm^2 at 100 keV. Halving the dose and doubling the energy provides adequately low resistance contacts without noticeable stress.

Plasma etching of all MNOS memory metallization has produced excellent geometry definition and low incidence of metal defects.

Experiments have been performed to determine the etch rates of masking silicon nitride, two kinds of memory silicon nitride, and silicon oxide while using reflux condensers to maintain etchant-bath stability. Etching rates of 80 Å/min. for the masking nitride and 90 Å/min. for

the other memory nitride were obtained. The oxide etch rate was approximately 3 Å/min. These data will be taken periodically until the effectiveness of the reflux condensers in maintaining consistency of etch rates can be determined.

E. MNOS Array Testing

The MNOS memory exerciser is in operation. Special drive circuits were built to interface to the 30 × 30 undecoded array and to 16- × 16-bit slices of the 64K one-level-decoded array.

In order to fully address the 64K memory, two interface boards have been designed and are being built. The word board consists of a decoder, analog switches, source drivers, and gate drivers. The digit board consists of decoders, analog switches, source drivers, gate drivers, and sense amplifiers.

In order to gather detailed data from the C-V curve of an MNOS memory capacitor, it is desirable to digitize and store the readout signal. For this purpose a digital oscilloscope has been purchased. It will be interfaced to the test system and operate with the memory exercisor.

F. Device Testing

MOS test devices are now being evaluated by the TIC computer test system. For the test transistors the measurements include drain leakage, gate leakage, threshold voltage, conductance, g_m, and dielectric strength. The process test devices at first-level metal provide sheet ρ measurements, breakdown measurements, and leakage measurements for gate, field, and MNOS oxides. A similar set of measurements is also made on devices with the second-level metal applied.

The MOS C-V test program has been modified to provide information on the density of fast-interface states. This requires the calculation of a theoretical C-V curve and comparison of the shape of the experimental and calculated curves. The variation in ΔV as a function of voltage is related to the density of interface states.

IV. EQUIPMENT AND SUPPORT

A. Ion Implanter

Most of the ion implanter modifications have been completed and the instrument is again operational. The ExB filter does not work and therefore we are not yet able to implant p^{++} and As^{++} beams.

B. FABSIM

FABSIM users have frequently been annoyed by long thermal oxidation simulation times. A study of thermox CPU usage revealed "bottlenecks" in the code. Changes were made resulting in a 50-percent CPU time reduction for a typical thermox process. Commands were added to FABSIM to permit saving and restoring profile information during a session. This should facilitate multi-step simulations. Impurity modeling was expanded to include antimony, and a test-dopant utility was implemented, permitting users to define their own impurity models. A comprehensive user's manual has been prepared. The program is being made available as a tutorial tool for students at M.I.T.

COMPUTER SYSTEMS
GROUP 28

During the quarter, use of the VM time-sharing systems has continued to grow such that morning and afternoon peak periods commonly exceed one hundred users. Loading of that level caused "thrashing," which is a condition characterized by processor pauses to wait for the transfer of user pages from an overburdened swapping drum. These pauses reduce the processor's total availability by as much as 15 to 20 percent at a time when it is most needed. The scheduler portion of the control program was modified to better handle this load level and reduce the problem.

Three significant initiatives of benefit to users were launched during the quarter. First, there was a meeting of mini- and micro-computer users to organize and document support software facilities available on the central IBM 370. There are now four cross-assemblers and two simulators in general service. A second initiative involved consulting and planning assistance to be provided through the coordinators designated by each Division. This function is aimed at improving general program design and selection of computing resources. Finally, an exploratory effort is being directed toward the requirements for a data management system. Because of the variety of data and user requirements and the two different file formats associated with the batch and time-sharing systems, it may not be practical to develop or acquire a single system for all users. This investigation is continuing.

The data communications system has been expanded again by the installation of another module on the second IBM 3705 Communications Controller. This and the addition of other features brings the total number of medium-speed start/stop lines to 240. The over commitment of channel addresses is possible because of the software switching capability previously reported. Of equal significance to the number of lines added is the fact that only two devices operate below 300 baud and thirty-two operate at 4800 baud.

SOLID STATE
DIVISION 8

INTRODUCTION

This section of the report summarizes progress during the period 1 February through 30 April 1978. The Solid State Research Report for the same period describes the work of Division 8 in more detail. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE.

A. L. McWhorter
Head, Division 8

I. Melngailis
Associate Head

DIVISION 8 REPORTS
ON ADVANCED ELECTRONIC TECHNOLOGY

15 February through 15 May 1978

PUBLISHED REPORTS

Journal Articles

JA No.			
4710	Micro-Fresnel Zone Plates for Coded Imaging Applications	N. M. Ceglio* H. I. Smith	Rev. Sci. Instrum. 49, 15 (1978)
4746	Spectroscopy and Lasing of a High Nd Concentration Al-Phosphate Glass	A. Lempicki* R. M. Klein* S. R. Chinn	IEEE J. Quantum Electron. QE-14, 283 (1978)
4784	High-Resistivity Layers in n-InP Produced by Fe Ion Implantation	J. P. Donnelly C. E. Hurwitz	Solid-State Electron. 21, 475 (1978)
4786	Collisionless Intramolecular Energy Transfer in Vibrationally Excited SF_6	T. F. Deutsch S. R. J. Brueck	Chem. Phys. Lett. 54, 258 (1978)
4793	1-mJ, Line-Tunable Optically Pumped 16 μm Laser	R. M. Osgood, Jr.	Appl. Phys. Lett. 32, 564 (1978)
4801	Efficient Phase-Matched Infrared Third-Harmonic Generation in Liquid CO-O_2-SF_6 Mixtures	S. R. J. Brueck H. Kildal	Opt. Lett. 2, 33 (1978)
4802	Simplified Fabrication of GaAs Homojunction Solar Cells with Increased Conversion Efficiencies	J. C. C. Fan C. O. Bozler R. L. Chapman	Appl. Phys. Lett. 32, 390 (1978)
4808	GaInAsP/InP Avalanche Photodiodes	C. E. Hurwitz J. J. Hsieh	Appl. Phys. Lett. 32, 487 (1978)
4810	Oriented Crystal Growth on Amorphous Substrates Using Artificial Surface-Relief Gratings	H. I. Smith D. C. Flanders	Appl. Phys. Lett. 32, 349 (1978)
4830	Proton Bombardment: For Making GaAs Devices	J. P. Donnelly C. O. Bozler R. A. Murphy	Circuits Mfg. 18, No. 4, 45 (1978)

Meeting Speech

MS No.			
4415	Ternary Semiconductor Crystals for Nonlinear Optical Applications	G. W. Iseler H. Kildal N. Menyuk	In Ternary Compounds, 1977, Conf. Ser. No. 35, edited by G. D. Holah (The Institute of Physics, Bristol and London, 1977), p. 73

* Author not at Lincoln Laboratory.

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UNPUBLISHED REPORTS

Journal Articles

JA No.			
4776	Explanation of the 6-fold LEED Patterns from Polar (0001) and (000$\bar{1}$) ZnO Surfaces	V. E. Henrich H. J. Zeiger E. I. Solomon* R. R. Gay	Accepted by Surf. Sci.
4797	Magneto-Optical Study of Shallow Donors in Transmutation Doped GaAs	J. H. M. Stoelinga* D. M. Larsen* W. Walukiewicz* R. L. Aggarwal* C. O. Bozler	Accepted by J. Phys. Chem. Solids
4803	Vibrational Energy Relaxation and Exchange in Liquid N_2-CO-OCS Mixtures	S. R. J. Brueck R. M. Osgood, Jr.	Accepted by J. Chem. Phys.
4811	Surface Defects and the Electronic Structure of $SrTiO_3$ Surfaces	V. E. Henrich G. Dresselhaus H. J. Zeiger	Accepted by Phys. Rev. B

Meeting Speeches†

MS No.			
4140G	Photoelectrolysis of Water	J. G. Mavroides	Physics Seminar, Dalhousie University, Halifax, Nova Scotia, Canada, 1 March 1978
4270B	Electron Spectroscopy of Surfaces: Defects on Transition-Metal Oxides	V. E. Henrich	Materials Science Seminar, M.I.T., 7 April 1978
4447A	Doppler-Limited Infrared Molecular Spectroscopy with a Tunable-Laser Difference-Frequency Converter	A. S. Pine	Seminar, National Research Council of Canada, Ottawa, Ontario, 27 March 1978
4447B	Doppler-Limited Infrared Molecular Spectroscopy with a Tunable-Laser Difference-Frequency Converter	A. S. Pine	Seminar, National Bureau of Standards, Washington, DC, 25 April 1978
4581A	The Electronic Structure of Transition-Metal-Oxide Surfaces: Defect States in Chemisorption	V. E. Henrich	Quantum Physics Seminar, Francis Bitter National Magnet Laboratory, M.I.T., 5 April 1978
4584	Advances in Schottky Diode Receivers and Planar GaAs Diode Detectors	H. R. Fetterman P. E. Tannenwald B. J. Clifton R. A. Murphy	Third Intl. Conf. on Submillimeter Waves and Their Applications, Guildford, England, 29 March – 1 April 1978

* Author not at Lincoln Laboratory.

† Titles of Meeting Speeches are listed for information only. No copies are available for distribution.

MS No.			
4584A	Schottky Diodes and their Application to Spectroscopy	H. R. Fetterman	Seminar, Francis Bitter National Magnet Laboratory, M.I.T., 3 May 1978
4588A	Acoustically Scanned Optical Imaging Devices	F. J. Leonberger	Optics Seminar, M.I.T., 8 March 1978
4608	Spectroscopic Studies of Small Molecule Intermediates on Metal Oxide Surfaces	R. R. Gay E. I. Solomon* V. E. Henrich H. J. Zeiger	175th Meeting, American Chemical Society, Anaheim, California, 16 March 1978
4635	Temperature and Magnetic Field Dependence of Nickel Carbonylation	M. S. Mehta* M. S. Dresselhaus* G. Dresselhaus* H. J. Zeiger	
4640	Lattice Modes of Fresnoite	T. Chieu* G. Dresselhaus* K. Ho* L. Schmutz* R. Silberstein* C. Underhill* T. B. Reed	American Physical Society Meeting, Washington, DC, 27-30 March 1978
4655	Electron Beam and X-ray Lithography	H. I. Smith	SPIE 31st Annual Conf., Washington, DC, 30 April – 5 May 1978
4664	High Power Laser and Low Noise Receiver for Submillimeter Thomson Scattering Ion Temperature Diagnostic	P. Woskoboinikow* H. C. Praddaude* D. R. Cohn* H. R. Fetterman P. E. Tannenwald B. J. Clifton	2nd Topical Conf. on High Temperature Plasma Diagnostics, Sante Fe, New Mexico, 1-3 March 1978
4665	Signal Processing with CCD's – A Complement to SAW's	A. M. Chiang	Boston Section IEEE Group on Sonics and Ultrasonics, Bedford, Massachusetts, 15 March 1978
4689	New Applications of Submicrometer Structures in Material Science and Biology	H. I. Smith D. C. Flanders D. C. Shaver	Scanning Electron Microscopy 1978, Los Angeles, 17-21 April 1978
4689A	New Applications of Submicrometer Structures	H. I. Smith D. C. Flanders D. C. Shaver	Cornell University Submicron Colloquium, Ithaca, New York, 23 February 1978
4689B	New Applications of Submicrometer Structures	H. I. Smith	Applied Physics Colloquium, California Institute of Technology, Pasadena, 19 April 1978
4689C	New Applications of Submicrometer Structures	H. I. Smith	Stanford University Colloquium, Palo Alto, California, 20 April 1978

*Author not at Lincoln Laboratory.

MS No.			
4689D	New Applications of Submicrometer Structures	H. I. Smith	IBM, San Jose, California, 21 April 1978
4691	High Sensitivity, 1.4 GHz Bandwidth 12-Element HgCdTe Photodiode Arrays for 10.6 μm Heterodyne Detection	D. L. Spears	26th National Infrared Information Symp., Air Force Academy, Colorado Springs, 9-11 May 1978
4709	Analog Signal Processing with Surface Acoustic Wave and Charge-Coupled Devices	E. Stern	IEEE Group on Electron Devices, Pittsburgh Chapter, 22 March 1978
4713	Neodymium Pentaphosphate Mini-Lasers	S. R. Chinn	Seminar, M.I.T., 12 April 1978
4729	Donor Spectra of High Purity Transmutation Doped GaAs	D. M. Larsen* J. H. Stoelinga* W. Walukiewicz* R. L. Aggarwal* C. O. Bozler	Neutron Transmutation Doping Conf., University of Missouri, Rolla, 23-26 April 1978
4739	Photodetectors for Fiber Optics	C. E. Hurwitz	Symp. on Components for Future EW Systems, MITRE Corporation, Bedford, Massachusetts, 11 May 1978
4950	Selective-Black Absorbers Using Sputtered Cermet Films	J. C. C. Fan	Intl. Conf. on Metallurgical Coatings, San Francisco, 3-7 April 1978

* Author not at Lincoln Laboratory.

SOLID STATE
DIVISION 8

I. SOLID STATE DEVICE RESEARCH

A gap-coupled InSb/$LiNbO_3$ acoustoelectric convolver has been operated at 77 K with an efficiency of −63 dBm. This result suggests the possibility of using a high-density InSb-diode-array/$LiNbO_3$ structure as an acoustically scanned infrared imaging device.

CW laser operation with an emission wavelength of 2.79 μm has been achieved at ~12 K in optically pumped liquid-phase epitaxially grown $Hg_{0.557}Cd_{0.443}Te$. Also, pulsed laser action has been observed at 77 K upon optically pumping various HgCdTe LPE samples with a Q-switched Nd:YAG laser. The stimulated emission wavelength varied from 1.25 to 2.97 μm as the mole fraction of CdTe changed from 0.729 to 0.410.

II. QUANTUM ELECTRONICS

A self-contained, hand-held NdP_5O_{14} laser has been fabricated. The laser head assembly of flash lamp, laser rod, and pump radiation collector has a volume of 1.5 cm^3. Without optimization, this unit presently provides ~1000 laser shots of 0.5 mJ at 1.06 μm between battery chargings.

A mini-TEA CO_2 laser has been operated with a "three-mirror" grating-tuned cavity and single-line tunability obtained in both the 10.6- and 9.4-μm branches. The mini-TEA laser has also achieved arc-free operation at pulse repetition frequencies up to 250 Hz and an average output power of 3.6 W.

An effort is under way to efficiently extract energy from the metastable levels of the mercury excimer. Experiments have been conducted which measure the wavelength, temperature, and density dependencies of infrared-laser-induced enhancement of the excimer fluorescence near 330 nm.

The recently developed GaAs Schottky-diode mixer has been used to generate tunable CW far-infrared radiation. Demonstration of high-resolution spectroscopy using this source has been made on D_2O.

The time scale of intramolecular vibrational energy transfer has important consequences for bond-selective infrared photochemistry. Measurements of the ν_3-band absorption of CO_2-laser-excited SF_6 have been carried out at fluences up to 1 J/cm^2. A redistribution of the vibrational energy takes place on a several-microsecond time scale, independent of SF_6 pressure.

The CO_2 TEA-laser induced dissociation of silane has been studied in order to improve the understanding of multiphoton excitation processes in unimolecular photochemistry. In contrast to SF_6, dissociation of SiH_4 requires pressures of a few Torr and is accompanied by visible luminescence from atomic and molecular hydrogen.

III. MATERIALS RESEARCH

Resistivity and Hall coefficient measurements have been made on numerous n-type (undoped, Sn-doped), p-type (Zn-doped, Cd-doped), and semi-insulating (Fe-doped) InP single crystals grown by the liquid-encapsulated Czochralski method to provide substrates for epitaxial growth of GaInAsP alloys for infrared diode lasers and detectors. For the Fe-doped sample with

lowest room-temperature carrier concentration ($n = 1.2 \times 10^7$ cm^{-3}), the room-temperature resistivity and Hall mobility are 1.6×10^8 Ω-cm and 3.3×10^3 cm^{2}V^{-1}sec^{-1}, respectively, and the activation energy determined by measuring the Hall coefficient as a function of temperature is 0.65 eV.

In a study of the liquid-phase epitaxial growth of GaInAs layers on InP substrates, the liquidus compositions and temperatures have been determined for deposition of the lattice-matched alloy $Ga_{0.47}In_{0.53}As$, a material of interest for infrared diode lasers, photodiodes, and photocathodes. To obtain this alloy with a given As concentration in the growth solution, the Ga concentration in the solution and the liquidus temperature must both be higher for (111)B substrates than for (100) substrates at growth temperatures below 690°C.

IV. MICROELECTRONICS

Silicon bolometers etched from single-crystal silicon wafers are being developed for use as broadband detectors in the 1- to 30-cm^{-1} band. The first detectors have noise equivalent powers of a few times 10^{-14} W/Hz$^{1/2}$ with single time constants of a few milliseconds, compared with a design goal of 2×10^{-15} W/Hz$^{1/2}$ with a 1/30-sec time constant.

A packaging technique for a SAW/CCD buffer memory device has been developed which allows mating the silicon chip with its sampling fingers and CCD structure to a lithium niobate delay line.

The first two-chip arrays of 100- × 400-element CCD imaging devices have been fabricated for the GEODSS Program and will be used to test the optical moving target indicator (MTI) system for automatic satellite detection. Recent tests on the 100- × 400-element CCD chips have shown that the measured dark current has been made as low as 6 nA/cm^2 over the entire device.

Matched filtering has been performed with a prototype device consisting of two 1-bit, 32-tap CCD programmable transversal filter sections which are capable of performing correlation of analog-sampled data with a binary reference. The programmable binary reference code of these devices is stored in an on-chip, serial-in/parallel-out n-MOS static shift register.

A processing sequence for the fabrication of two-phase, buried-channel CCDs has been developed which is compatible with the fabrication of n-MOSFETs having high punch-through voltages and low back-gate-bias effects.

To produce uniform alignment of the director in nematic and smectic liquid-crystal layers, 320-nm spatial-period square-wave gratings fabricated on amorphous SiO_2 substrates were used. This demonstrates that molecular alignment can be achieved using surface structures fabricated by a planar process. A novel method of producing twisted-nematic liquid-crystal displays using surface gratings has been demonstrated.

V. SURFACE-WAVE TECHNOLOGY

A filter has been developed whose bandwidth can be continuously varied over a range from 3 to 100 MHz by changing the frequency of a CW control signal. This filtering system exploits the extremely sharp skirts (−3 to −40 dB in 3.5 MHz) achievable with reflective-array-compressor (RAC) devices. Amplitude response, phase response, out-of-band rejection, and dynamic range of the filter system have been measured.

A specialized assembly procedure has been developed for gap-coupled acoustoelectric devices consisting of a $LiNbO_3$ delay line and a silicon strip separated by an intervening air gap. Air gaps of the order of 0.2 to 0.6 μm can be accurately obtained and held uniform to within ±0.02 μm over lengths as large as 7 cm. The procedure achieves this goal by maintaining extreme cleanliness while employing specialized mountings and jigs for accurately assembling the separate parts.

A memory-correlator subsystem with a bandwidth of 60 MHz and correlation length of 5 μsec has been developed. The key element of the subsystem is an improved acoustoelectric memory correlator which functions as a programmable matched filter. Improvements include the use of a spacer-rail support structure to control transverse modes, the use of multistrip couplers to reduce spurious bulk-wave signals, and the use of a balanced transformer feed to reduce direct EM feedthrough. The required interfaces, drive circuits, and output circuits have been developed and incorporated in the memory-correlator subsystem.

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This Quarterly Technical Summary covers the period 1 February through 30 April 1978. It consolidates the reports of Division 2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program.

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